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Sustainable Resource Management

Tools and Techniques

THE FEAR OF THE LORD IS THE BEGINNING OF WISDOM

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ECONOMIC EVALUATION APPROACH FOR ASSESSING MARINE ECOSYSTEM IN INDIA

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Introduction

The economy has a complex relationship with the environment. The environment not only provides the raw materials and energy for the production of goods and services that support people's lifestyles, but also sustains damage through the activities of households and businesses. Environmental economics, being a sub-field of economics, is concerned with environmental issues. According to the quoting from the National Bureau of Economic Research Environmental Economics program, 'Environmental Economics undertakes theoretical or empirical studies of the economic effects of national or local environmental policies around the world. Particular issues include the costs and benefits of alternative environmental policies to deal with air pollution, water quality, toxic substances, solid waste, and global warming". Environmental economics seeks to assess various losses due to the economic activities and to fix upon the most competent way to reduce them, as well as to compare the cost of environmental damage to the cost of mitigation.

The processes by which the resources such as clean water, timber, habitat for fisheries, pollination of native and agricultural plants, etc produced by the environment is known as "Ecosystem services". An ecosystem is a community of animals and plants interacting one another along with the physical and chemical components, such as soils, water, and nutrients that support organisms living within them. While it is often impossible to place an accurate monetary amount on ecosystem services, we can calculate some of the financial values. Many of these services are performed seemingly for "free," yet are worth many trillions of dollars, for example: 80% of the world's population relies upon natural medicinal products. Of the top 150 prescription drugs used in the U.S., 118 originate from

natural sources: 74% from plants, 18% from fungi, 5% from bacteria, and 3% from one vertebrate (snake species). Nine of the top 10 drugs originate from natural plant products. Hence, it is very important to be aware of the relevance of ecosystem services in human life. The choices we make today in how we use ecosystem services will have enormous consequences on the future sustainability of earth's ecosystems and the services they provide.

Marine Ecosystem

Marine and coastal wetlands encompass the enormous variety of marine and coastal species and open sea habitats and ecosystems, and the wealth of ecological processes that support all of these. Considering marine ecosystems, they are among the largest of Earth's aquatic ecosystems including oceans, salt marsh and intertidal ecology, estuaries and lagoons, mangroves and coral reefs, the deep sea and the sea floor. Marine ecosystems are very important for the overall health of both marine and terrestrial environments. According to the World Resource Center, coastal habitats alone account for approximately 1/3 of all marine biological productivity, and estuarine ecosystems (i.e., salt marshes, sea grasses, mangrove forests) are among the most productive regions on the planet. In addition, other marine ecosystems such as coral reefs provide food and shelter to the highest levels of marine diversity in the world. Marine ecosystems usually have a large biodiversity and are therefore thought to have a good resistance against invasive species.

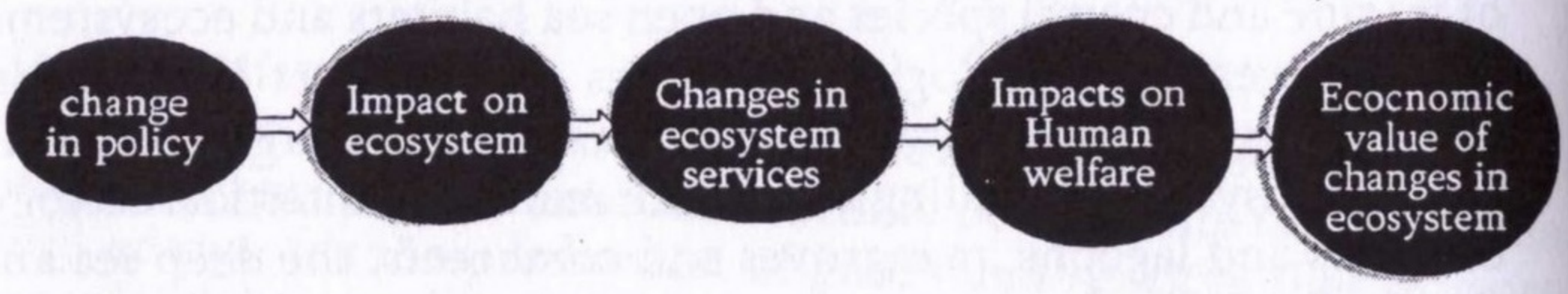
Coastal zone has high biological potential as it serves as feeding, nursery and spawning grounds with rich biodiversity and as an intermediary biotope between marine and freshwater environments.

The marine fauna of India is rich and varied. The coastline encompasses almost all types of intertidal habitat, from hyper saline and brackish lagoons, estuaries, and coastal marsh and mudflats, to sandy and rocky shores with every degree of exposure and widely varying profile. Tropical marine ecosystem of Kerala coast includes lagoons, mangrove swamps, sandy and rocky shores and opens sea front.

Valuation of Ecosystem

The Ecosystem services contribute to economic welfare in two ways – through contributions to the generation of income and

wellbeing and through the prevention of damages that inflict costs on society. Both types of benefits should be accounted for in policy appraisal. With a broader focus on valuing the benefits provided by ecosystems, policy options that enhance the natural environment are also more likely to be considered that demonstrate that investing in natural capital can make economic sense. The popular way of valuing ecosystem services is an impact pathway approach, which is presented below;



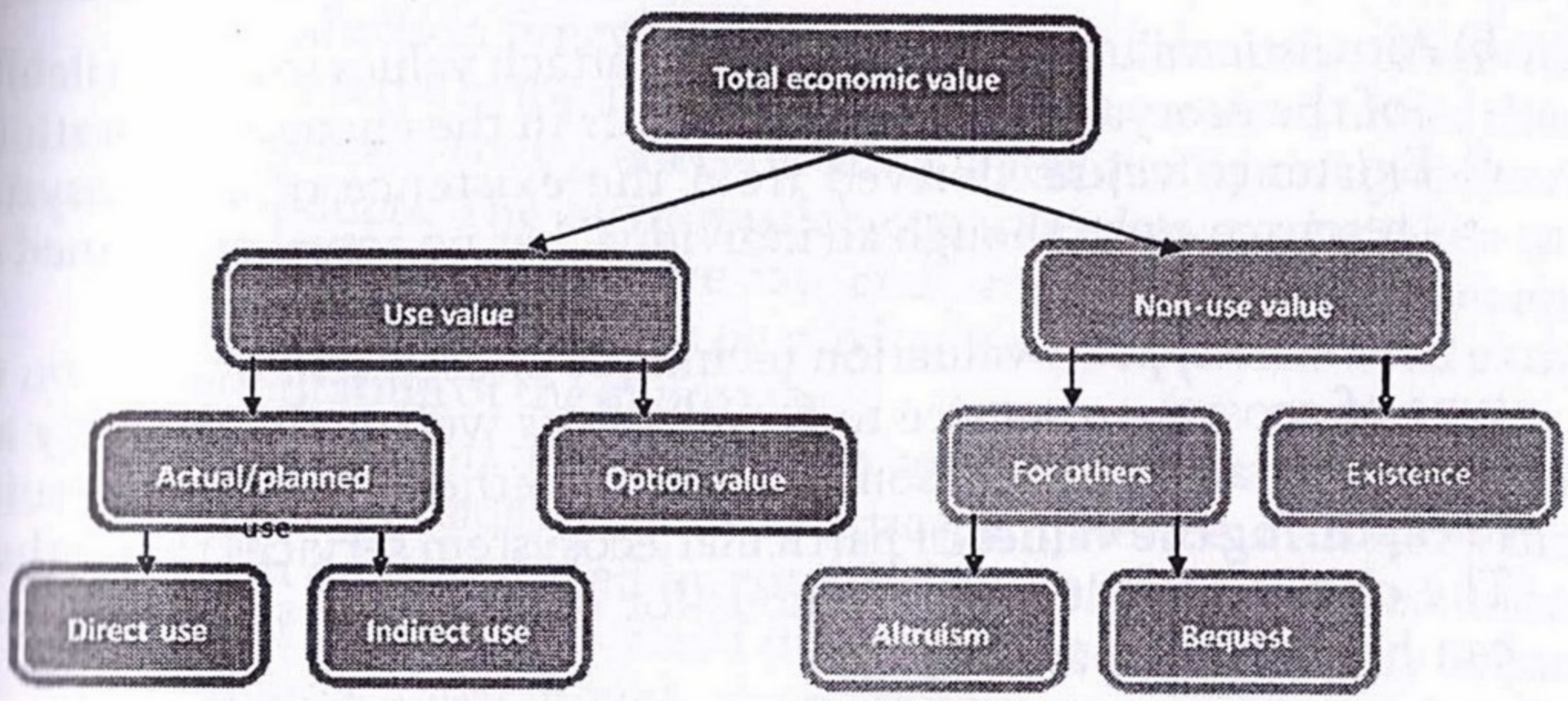
In an impact pathway approach, the impacts on an ecosystem due to the change in policy are observed. Following this there may be changes in ecosystem services which impacts on human welfare and by observing this the overall economic value of changes in ecosystem can be done.

In brief, the key steps involve;

- Establishing the environmental baseline.
- Identifying and providing qualitative assessment of the potential impacts of policy options on ecosystem services.
- Quantifying the impacts of policy options on specific ecosystem services.
- Assessing the effects on human welfare.
- Valuing the changes in ecosystem services.

All these steps ensure a more systematic approach to accounting for impacts on ecosystems. Even though, there is considerable complexity in understanding and assessing the causal links between a policy, its effects on ecosystems and related services and then valuing the effects in economic terms. Integrated working with policy, science and economics disciplines will be essential in implementing this approach in practice.

A range of methodologies are available to value changes in ecosystem services which are considered in a Total Economic Value framework that takes into account both the use and non-use values. The total economic value framework is presented below;

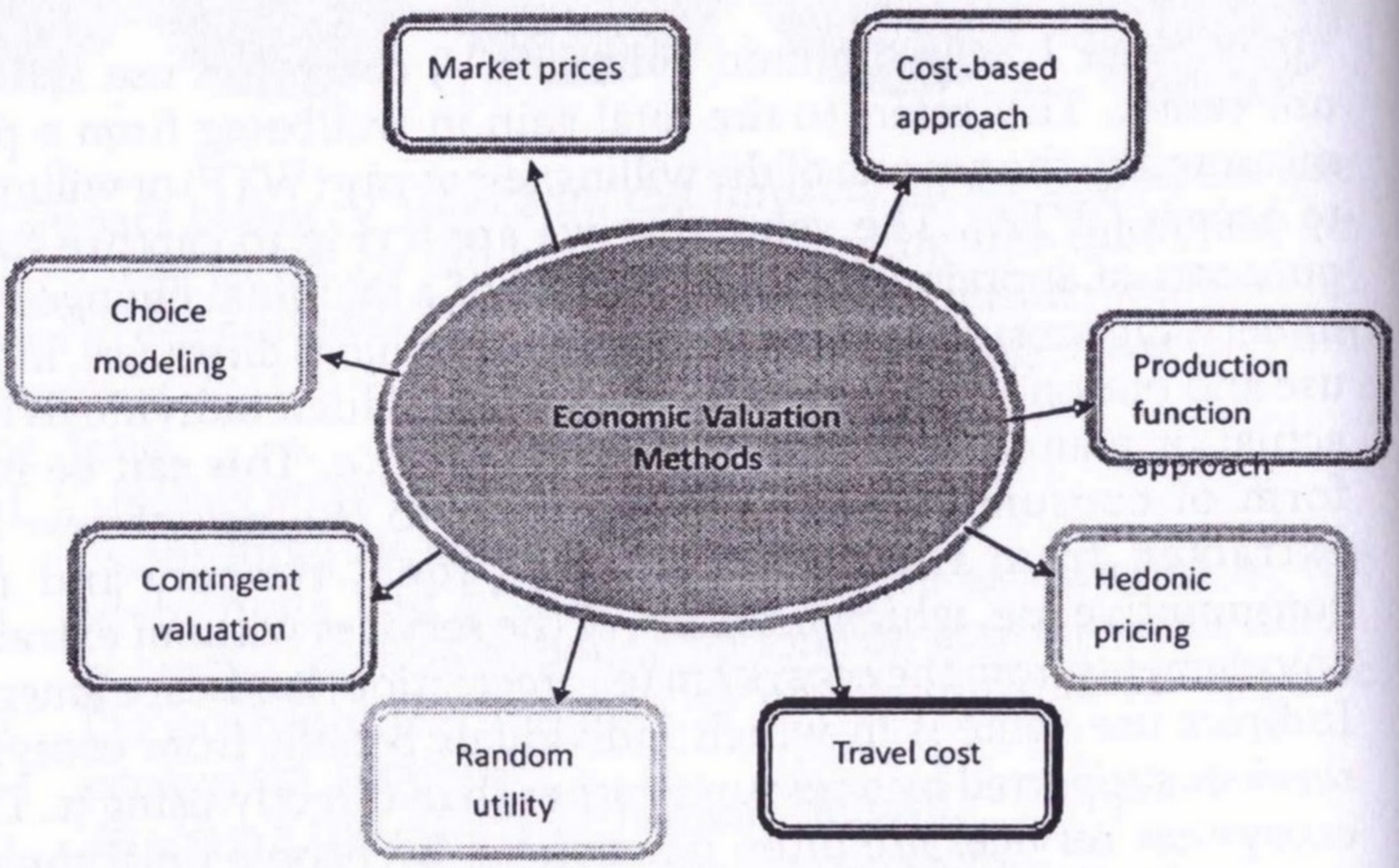


The Total Economic Value (TEV) comprises use and non-use values. TEV refers to the total gain in wellbeing from a policy measured by the net sum of the willingness to pay (WTP) or willingness to accept (WTA). The value that we are trying to capture for the purposes of appraisal is the total value of a marginal change in the underlying ecosystem services. **Use value** includes direct use, indirect use and option value. Direct use value is in which individuals make actual or planned use of an ecosystem service. This can be in the form of consumptive use which refers to the use of resources extracted from the ecosystem (e.g. food, timber) and non-consumptive use, which is the use of the services without extracting any elements from the ecosystem (e.g. recreation, landscape amenity). Indirect use value is in which individuals benefit from ecosystem services supported by a resource rather than directly using it. These ecosystem services are often not noticed by people until they are damaged or lost, yet they are very important. These services include key global life-support functions, such as the regulation of the chemical composition of the atmosphere and oceans, and climate regulation, water regulation, pollution filtering, waste decomposition and pollination. Option value is that in which people place on having the option to use a resource in the future even if they are not current users. **Non-use value** (also known as passive use) is derived simply from the knowledge that the natural environment is maintained. There are three main components:

a) Bequest value: where individuals attach value from the fact that the ecosystem resource will be passed on to future generations.

b) Altruistic value: where individuals attach values to the availability of the ecosystem resource to others in the current generation.
c) Existence value: derived from the existence of an ecosystem resource, even though an individual has no actual or planned use of it.

The type of valuation technique chosen will depend on the type of ecosystem service to be valued, as well as the quantity and quality of data available. Some valuation methods may be more suited to capturing the values of particular ecosystem services than others. The choice of valuation methods for different ecosystem services can be picturised as follows;

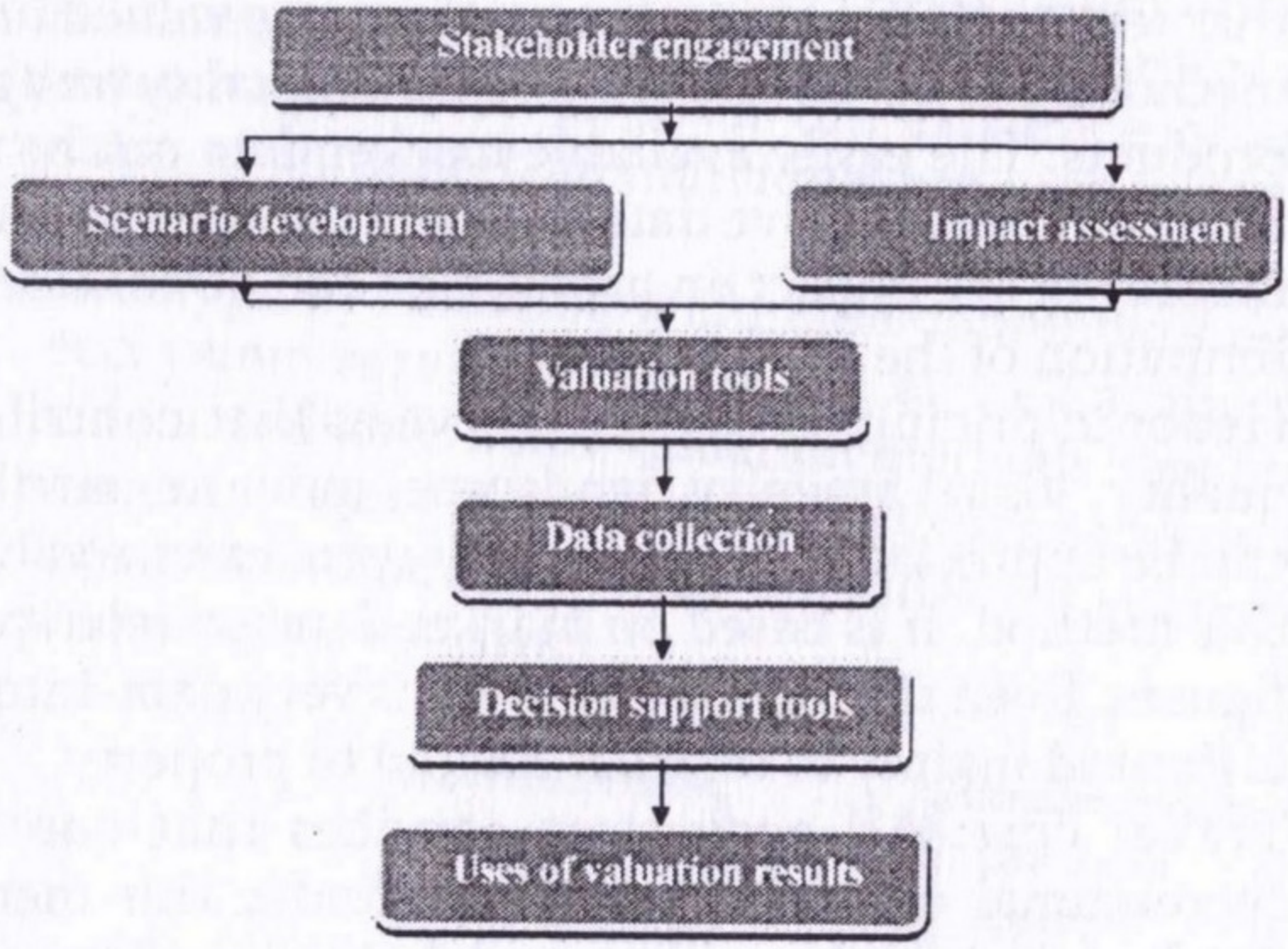


The details of the various economic valuation methods are as follows;

1. Market prices: This method is used for valuing items like timber, fish, genetic information etc which contributes to marketed products. The readily available market data can be pointed out as the benefit of this method. But the method is limited to those ecosystem services for which a market exists.
2. Cost-based approach: The usage of this method depends on the existence of relevant markets for the ecosystem service in question. The benefit of the method is the readily available market data whereas there is a possibility of the overestimation of the actual value too.

3. Production function approach: The environmental services that serve as input to market products are valued under these methods. For eg, effects of air or water quality on agricultural products. The easily available market data can be taken as a benefit. The intensive data and data changes in services and missing of the impact on production can be considered as the limitation of the approach.
4. Hedonic pricing: Ecosystem services that contribute to air quality, visual amenity, landscape, quiet i.e. attributes that can be appreciated by potential buyers can be valued under this method. It is based on market data, so relatively robust figures. Even though, the method is very data-intensive and is limited mainly to services related to property.
5. Travel cost: All ecosystem services that contribute to recreational activities are valued under this method. The method is based on observed behavior. The method is generally limited to recreational benefits. Difficulties in valuation arise when trips are made to multiple destinations.
6. Random utility: All ecosystem services that contribute to recreational activities are valued under this method. The method is based on observed behavior. The method is generally limited to use values.
7. Contingent valuation: All ecosystem services are valued by this method. The benefits of the approach are that it is able to capture use and non-use values. The limitation of the method is that there may be bias in responses. Moreover it is a resources-intensive method and also the market is of a hypothetical nature.
8. Choice modeling: All ecosystem services are valued by this method and it is able to capture use and non-use values. The limitation of the method is that there may be bias in responses. Moreover it is a resources-intensive method and also the market is of a hypothetical nature.

The steps involved in an economic valuation are depicted in the flow chart below.



For a better picture, lets take the example of Sathar island of Paravur taluk, Ernakulam district. Sathar Island is a small village under vadakkekara panchayath and is located in the border of Ernakulam and Thrissur districts. The island is having a total area of 4km inhabited by 122 families, with a total population of 600. Considering the marine ecosystem of Sathar Island, the island is having mangroves, salt marshes, and estuary.

Having access to reliable information that describes the costs, values, and risks of environmental change facilitates more objective, more transparent and more informed decision making in a small island like Sathar island. Even though an economic valuation does not provide the 'correct' answer, it does provide information to facilitate more objective decision making, therefore it should always be undertaken within the context of sustainable development.

In the case of Sathar island , the market price valuation method can be used for valuing the ecosystem services as there exist market for fish which from the mangroves, salt marshes and estuary of the island. The production function approach can also be used for evaluating as there are inputs to market products available from the ecosystem.

Conclusion

Ecosystems provide a myriad of services that contribute to human survival and quality of life. While making out the process of economic valuation two important caveats should be remembered;

firstly, economic valuation is just one element in a decision process, along with a number of other steps that require expertise beyond the economic domain. Secondly, each new project or policy to be studied may require a slightly different approach from the previous study. The main lesson to be learnt is that economic valuation is about asking the right questions and about putting the story on the table. Each valuation method has advantages and disadvantages, and should be carefully chosen based on the specific goals and subject of the study. Not only are there issues with individual methods, but there are issues with economic theory and the idea of economically valuing ecosystem services in general.

Despite difficulties, limitations, and issues surrounding ecosystem service valuation, there does seem to be a general consensus that the value of ecosystem services often outweighs economic use and that protecting ecosystem services is, or should be, one of the most important responsibilities of today's politicians, resource managers, and society in general (Balmford et al. 2002; Daily 1997b; Salzman, Thompson, and Daily 2001)

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